Figure 1
WCT Symbols in Flow Diagrams and in Figures 1 through 23A

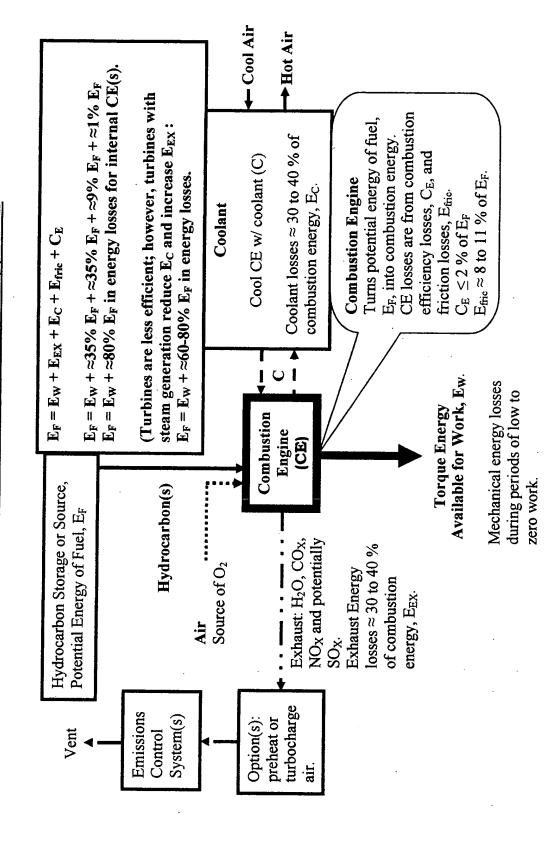
Symbol	Description	Notes
	Description	CE can be any combustion design as is known in the
Combustion Engine (CE)	Combustion Engine	art, i.e. internal combustion design as is known in the art, i.e. internal combustion engine, turbine, furnace, etc. CE combines fuel and ignites fuel with a spark generation device. Fuel is most preferably O ₂ , H ₂ and H ₂ O. Fuel is preferably O ₂ and H ₂ . Fuel can be used in combination with air.
	Gas Compressor	Used in Cryogenic Refrigeration. Designs are plentiful in the art. Compressor symbols: A = Air, D1 = First Distillation, D2 = Second Distillation, O1 = O2, H1 = H2, O = O2 Storage and H = H2 Storage.
\triangleright	Joule-Thompson	Two types are normally used in the art -
	Expansion Valve	1. An expansion valve, 2. A cylinder.
	Separation (Distillation Column)	Diameter and Height dependent upon separation efficiency and loading. Separation efficiency dependent upon compounds separated and column packing. Distillation Temperatures are relative to Separation Operating Pressure. Depending on the desired O ₂ purity, the second O ₂ /N ₂ separation column is optional.
<u> </u>	Heat Exchanger to	During normal operation, it is preferred that the waste
Q X'fer	cool compressed	N ₂ is coolant. Depending upon design, upon start-up
	gases	water may be necessary for an efficient start-up.
	Cryogenic Storage Tank	Tank is to be made of materials known in the art to withstand liquid cryogenic temperatures/pressure of O ₂ and/or H ₂ . Tank may have refrigeration loop per Figure 13, which operates of off at least one of: the combustion engine, a battery and a fuel cell.
T +	Turbine	Depending upon application, turbine is to be turned by steam, air or water movement. Turbine is preferred to generate electricity, preferably driving a generator and/or alternator. It is most preferred that the electricity performs electrolysis.
PC	Pressure Controller	Pressure controller can be of any design as is known in the art. PC protects downstream equipment from pressure surges. In high pressure surge situations, PC vents to the atmosphere.
Q	Energy in the form	Energy is transferred (managed) during many
	of heat	methods, processes and systems of this invention.
C O N T	Fuel Mixture Controller	H ₂ , O ₂ , H ₂ O, air bypass and engine coolant. Controller manages fuel mixture ratios. H ₂ O ratio in combustion is managed depending upon combustion temperature and/or engine temperature. Air bypass is to be managed depending upon O ₂ tank level. Engine coolant loop dependant on high engine temperature.

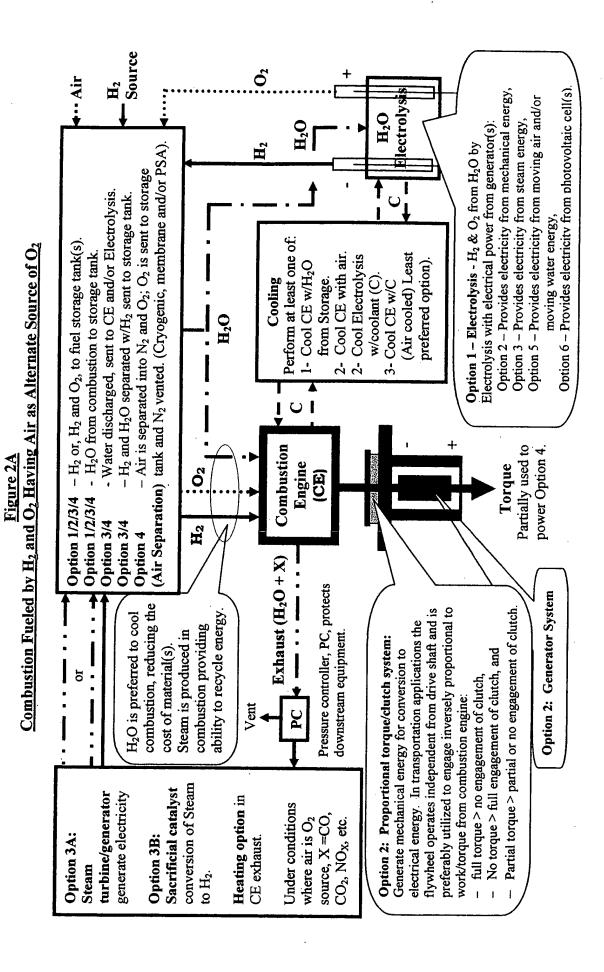
Figure 1A
WCT Symbols in Flow Diagrams and in Figures 1 through 23A

Symbol	Description	Notes
	Clutch	Used to transfer E _w to at least one of a flywheel and a generator. Clutch preferably engages during periods of little to no work and disengaged during periods of work. Design and assembly to be as known in the art.
	Flywheel	Used to store rotational kinetic energy during periods of little to no work; rotational energy to be utilized during periods of work.
+	Generator	Used to generate electrical energy. Generator can be of the type to generate an alternating current (A/C), such as in power generation applications or a Dynamo to generate a direct current (D/C) to power electrolysis. A/C current can be turned into D/C with an A/C to D/C converter and D/C can be turned into A/C with a D/C to A/C converter.
+ H ₂ O Electrolysis	Electrolysis	Electrolysis of H ₂ O to O ₂ and H ₂ is to be performed. Electrolysis is to be performed by methods and systems known in the art of electrolysis. It is most preferred that an electrolyte be present in the H2O to further electrolysis and the efficiency of electrolysis. It is preferred that the electrolysis unit be cooled.
	Air Line	Line primarily contains air.
***********	O ₂ Line	Line primarily contains O ₂ .
	N ₂ Line	Line primarily contains N ₂ .
	H ₂ Line	Line primarily contains H ₂ .
	H ₂ O Line	Line primarily contains H ₂ O.
	Products Line	Line primarily contains combustion products, preferably H ₂ O, yet can be H ₂ O and X, wherein X is N ₂ , CO _X and NO _X and can contain SO _X .
	Coolant (C) Line	Line symbol indicates flow of coolant, which is preferably used with electrolysis. C can be used with CE; however this is not preferred. C can be any type as is known in the art; coolant is preferred a mixture of water, glycol, corrosion inhibitor and dispersant.
	Control Line	Electrical or pneumatic line. Electrical wire carrying a small current, preferably 4 to 20 mA. Pneumatic line may carry a gas and/or a liquid under pressure.
	Flow Transmitter	Used in combination with control line and controller
	& Control Valve	(CONT.) to control flow of fuel and/or coolant (C)
+ Q	Coolant Radiator	Used to release heat from coolant and pump back to heat source. Preferably used for electrolysis. Preferably used to cool oil for CE. It is not preferred to cool CE.

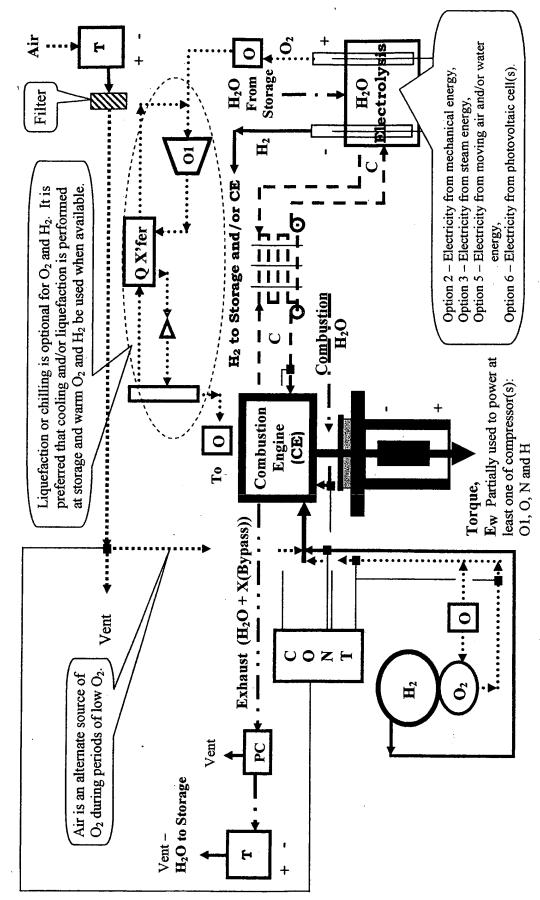
Figure 2

Traditional Combustion - Combustion Fueled by Hydrocarbon(s) and Air





Combustion Fueled by H2 and O2 with Air as Alternate- Electrolysis Figure 3

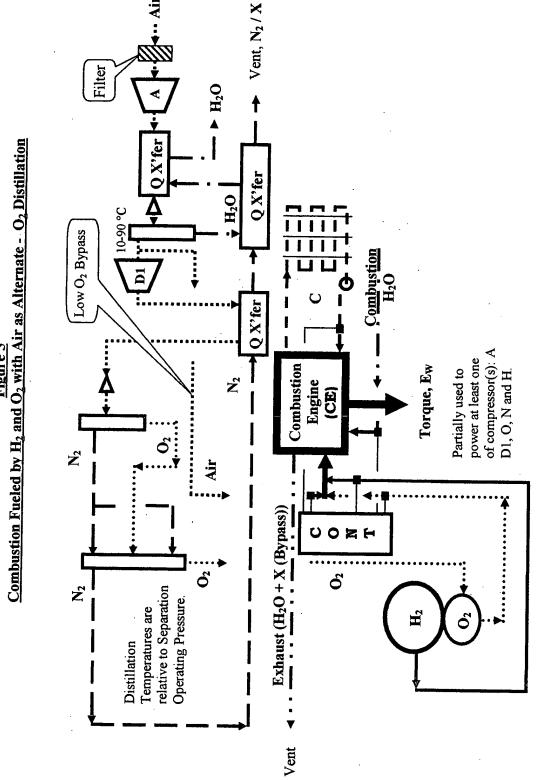


Air is an alternate source of O₂ during periods of low O₂. Filter Combustion H₂O power at least one Combustion Torque, Ew of compressor(s): Partially used to H1, O, N and H. Engine (CE) O₂ Bypass Exhaust (H2O +X (Bypass)) Vent COME Vent Converter Catalyst Vent H \mathbf{H}_2 H₂

Combustion Fueled by H₂ and O₂ with Air as Alternate - H₂ Catalysis

6 of 28

Figure 5
Combustion Fueled by H₂ and O₂ with Air as Alternate - O₂ Distillation



7 of 28

Option 6 - Electricity from photovoltaic cell(s). Option 2 - Electricity from mechanical energy, H₂O from Storage O Option 5 - Electricity from moving air and/or lectrolys H,0 Option 3 - Electricity from steam energy, Filter Combustion Fueled by H₂ and O₂ with Air as Alternate - Electrolysis - H₂ Catalysis water energy, Jo V X'fer H₂. Liquefaction and/or chilling is preferred for Liquefaction or chilling is optional for O2 and storage. Warm generated fuel bypass to CE is most preferred in the case of liquefied storage. Combustion at least one of compressor(s): O1, H1, O, N and H. Ew Partially used to power Combustion Engine (CE) Forque, Exhaust Vent OOZH Vent alternate source of O2 during PC Low O₂ Bypass. Air is an periods of low O2. Converter Catalyst H H Storage \mathbf{H}_2 H₂O to \mathbf{H}_2

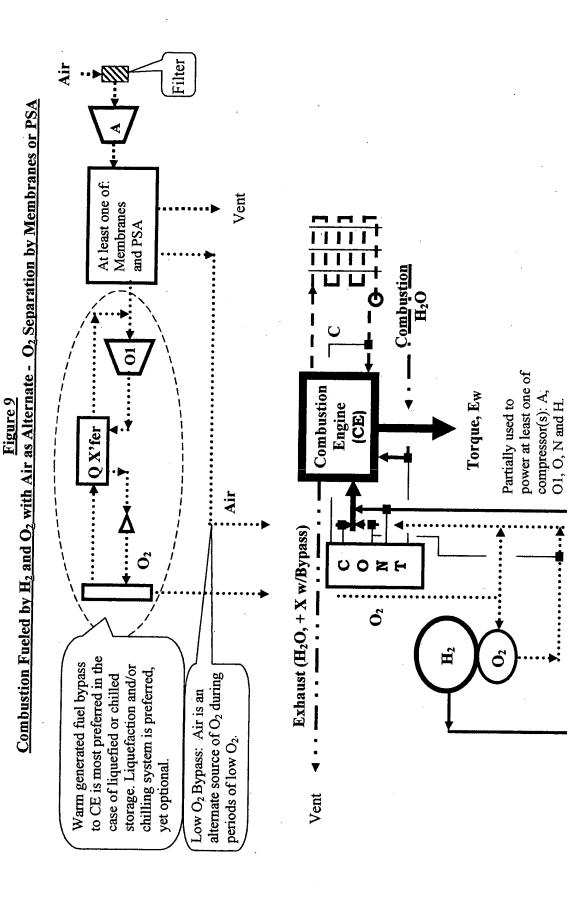
8 of 28

Vent, ► H₂O To O 0 Option 5 - Electricity from moving air and/or water lectrolysi Storage energy, Option 6 – Electricity from photovoltaic cell(s). Option 2 – Electricity from mechanical energy, Option 3 – Electricity from steam energy, Air ... H,0 from H_2O To H Filter ₹0 X'fer Q X'fer H_2O 2° 06-01 Combustion H₂O H_2 Q X'fer Low O₂ Bypass 0 least one of compressor(s): Partially used to power at A, D1, D2, O, N and H. Combustion \mathbf{H}_2 Engine (CE) O Torque, H_2 , N_2 Air Exhaust $(H_2O + X (Bypass))$ | ◆ # 0 CORF 0, Õ H2, N2 Õ \mathbf{H}_2 H2 \mathbb{H}_2 O X'fer Storage H₂O to Vent -Z +

Combustion Fueled by H₂ and O₂ with Air as Alternate - Electrolysis - O₂ Distillation

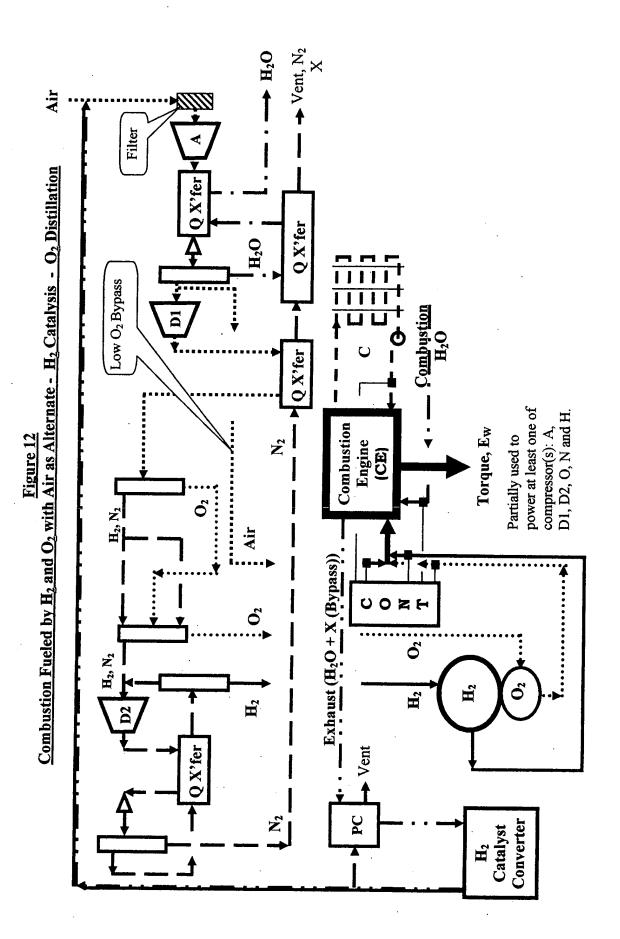
9 of 28

10 of 28



12 of 28

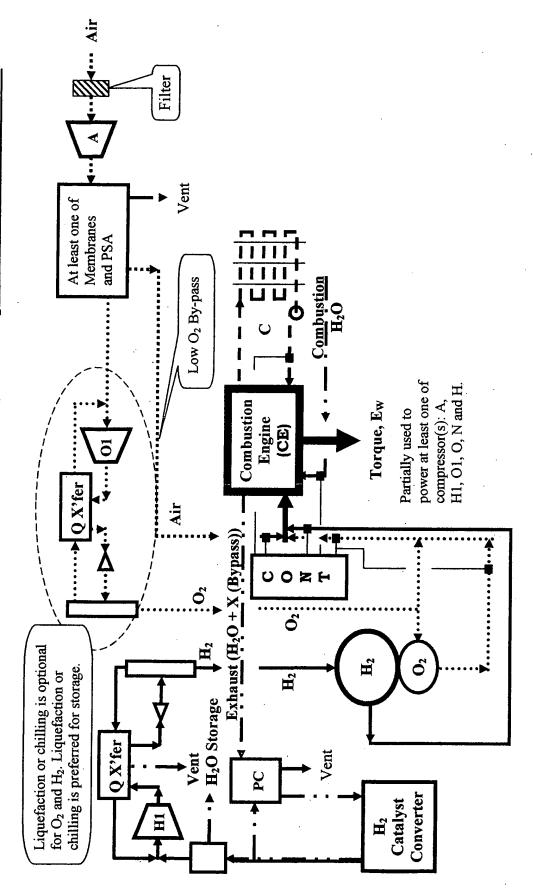
13 of 28



14 of 28

15 of 28

Combustion Fueled by H₂ and O₂ with Air as Alternate - H₂ Catalysis O₂ Separation by Membranes or PSA Figure 13



Air Air Filter Combustion Fueled by H2 and O2 with Air as Alternate - H2 Catalysis during periods of low O2 tank level. Combustion H₂O Air is an alternate source of O₂ least one of compressor(s): H1, O, N and H. Ew Partially used to power at Combustion Figure 14 Engine (CE) Bypass Low O₂ Torque, Exhaust (H2O +X (Bypass)) Vent COZE PC H2O to Storage Converter Catalyst

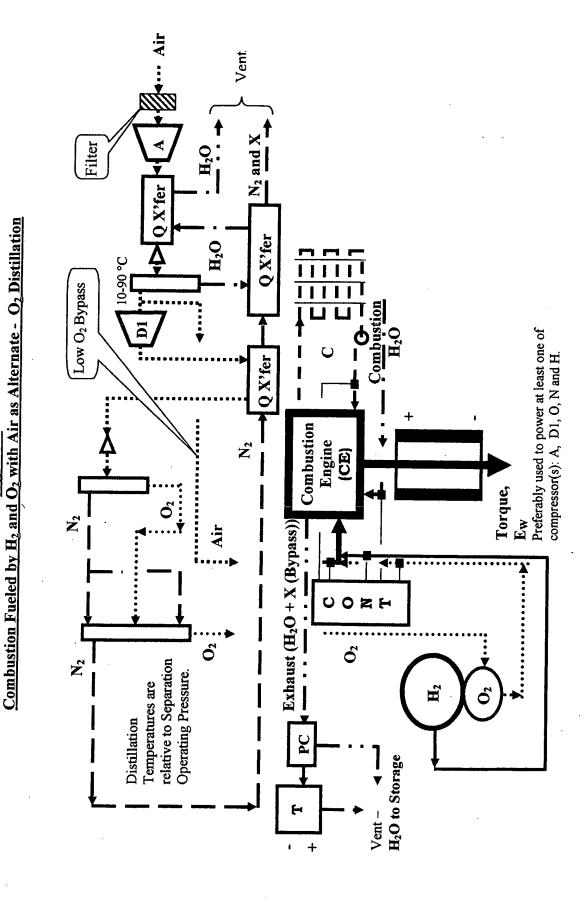
Vent -

HI

 \mathbf{H}_2

16 of 28

17 of 28



of compressor(s): A, O1, O, N and H. Preferably used to power at least one Combustion Engine 18 of 28 (CE) O X'fer Torque,

Exhaust (H₂O, + X w/Bypass)

0

H₂O to Storage

Vent -

Combustion H₂O

Filter

Vent

Air

inadequate membrane

separation.

... Air

At least one of:

generated fuel bypass to CE is most preferred in the case of

liquefied or chilled storage.

Low O2 Bypass. Air is

an alternate source of O₂ during periods of low O2 tank level or

preferred for storage. Warm

Liquefaction or chilling is

Membranes and PSA

01

Combustion Fueled by H₂ and O₂ with Air as Alternate - O₂ Separation by Membranes or PSA

Vent Filter Combustion Fueled by H₂ and O₂ with Air as Alternate - H₂ Catalysis - O₂ Distillation O X'fer O X'fer H_2O Low O₂ Bypass VQ X'fer Preferably used to power at least one of compressor(s): A, D1, D2, O, N and H. Combustion \mathbf{Z}^{2} Engine (CE) Torque, Ew H_2 , N_2 Air Exhaust (H₂O + X (Bypass)) COME 0 02 H_2, N_2 Õ \mathbf{H}_2 \mathbf{H}_2 \mathbf{H}_2 H2O to Storage Vent -O X'fer \mathbf{PC} Z Converter Catalyst \mathbf{H}_2

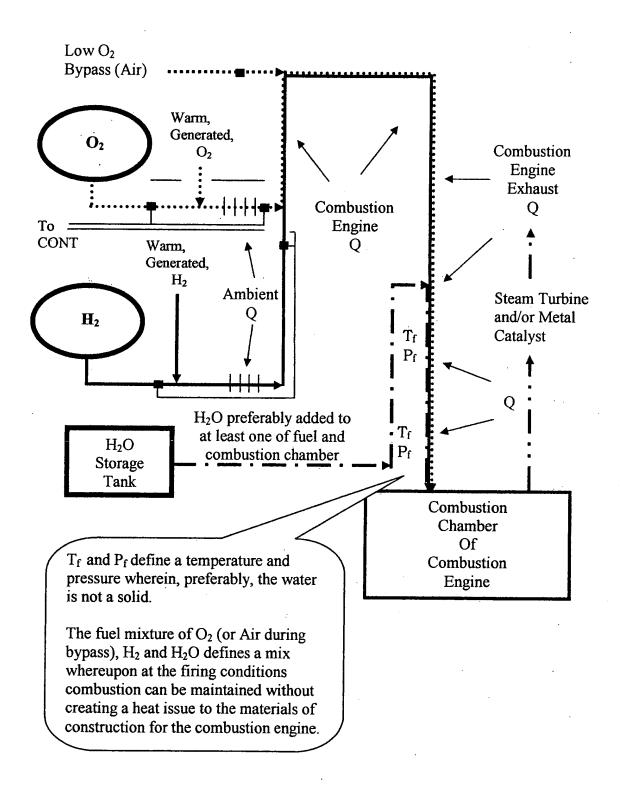
19 of 28

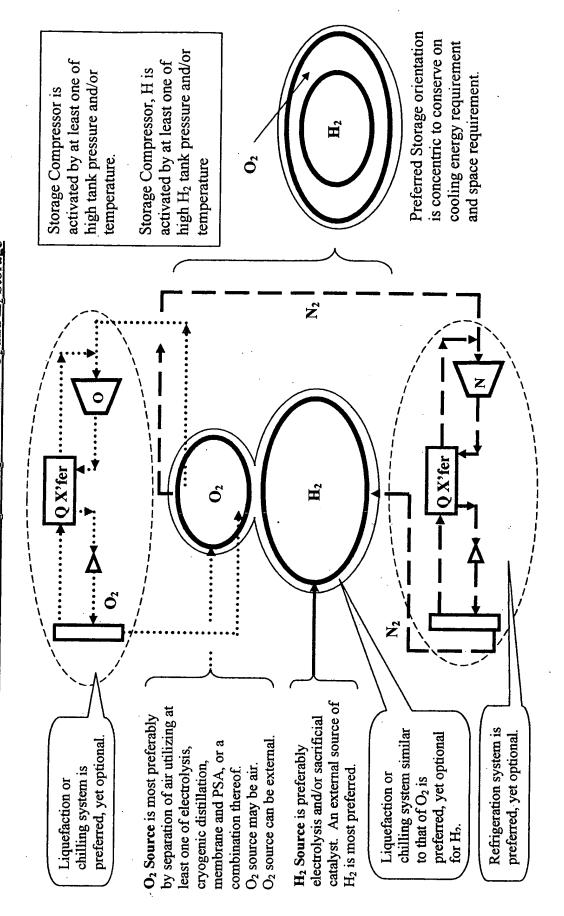
20 of 28

A, H1, O1, O, N and H.

Air Air Filter Combustion Fueled by H₂ and O₂ with Air as Alternate - H₂ Catalysis O₂ Separation by Membranes or PSA Combustion H₂O Vent At least one of Membranes and PSA Low O₂ By-pass Partially used to power at least one of compressor(s): Torque, Ew Combustion Figure 18 Engine (CE) Air + X (Bypass)COME O 0 bypass to CE is most preferred in the Exhaust (H20 Liquefaction or chilling is preferred O_2 case of liquefied or chilled storage. \mathbf{H}_2 for storage. Warm generated fuel \mathbf{H}_2 Storage ►H₂O to Vent -► H₂O Storage O X'fer Vent PC Converter Catalyst \mathbf{H}_2 H

Figure 19
Combustion Fueled by H₂ and O₂ and/or Air - Fuel Preheating





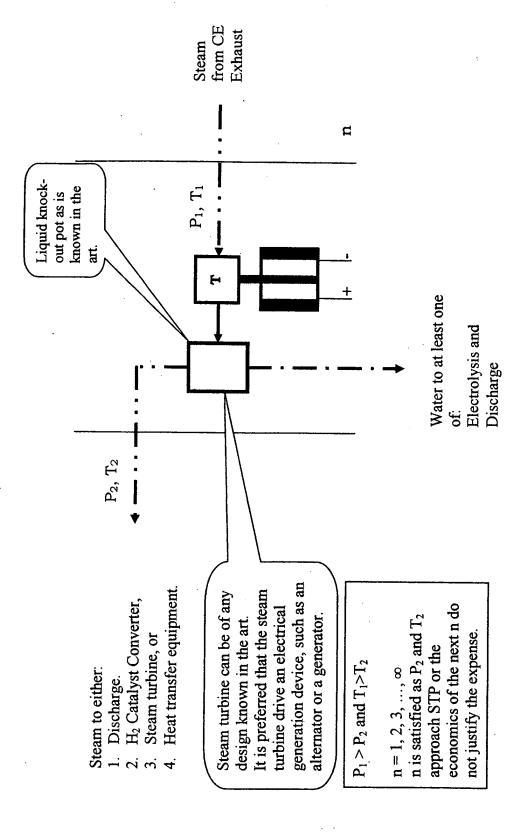
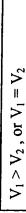


Figure 21A

O₂ Separation Combustion turbine(s) preferably to generate electrical energy. Membrane Cryogenic Separation and/or and/or PSA From CE Torque Steam Turbine(s) preferably to generate electrical energy. Bypass O (Preferred) Combustion H₂ H₂O Turbine Engine (CE) P_N and T_N , wherein c = combustion. $N \ge 1$, wherein N = turbine stage. In-Line Combustion and Steam Turbine Configuration(s) Side View Pc, Tc Flow of Water (Condensed H₂O) $P_2 > P_3$ and $T_2 > T_3$ $P_1 > P_2$ and $T_1 > T_2$ $P_3 > P_4$ and $T_3 > T_4$ P_1 , T_1 $P_c > P_1$ and $T_c > T_1$ Flow of Steam (H₂O Vapor) P_2 , T_2 P3, T3 P4, T4 Vent **End View** Turbine Electrolysis and Discharge Water to at least one of: Low Pressure Steam to either: Vent • Heat transfer equipment. H2 Catalyst Converter, Steam turbine, or Discharge, Vent. Combustion End View



It is preferred that $V_1 > V_2$

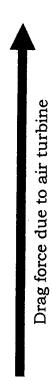
 $n=1,\,2,\,3,\,\ldots,\,\infty$

n is satisfied as V_2 approaches 0 or the economics high (such would not be the case for a sail boat). transportation application, the drag force is too of the next n do not justify the expense or for

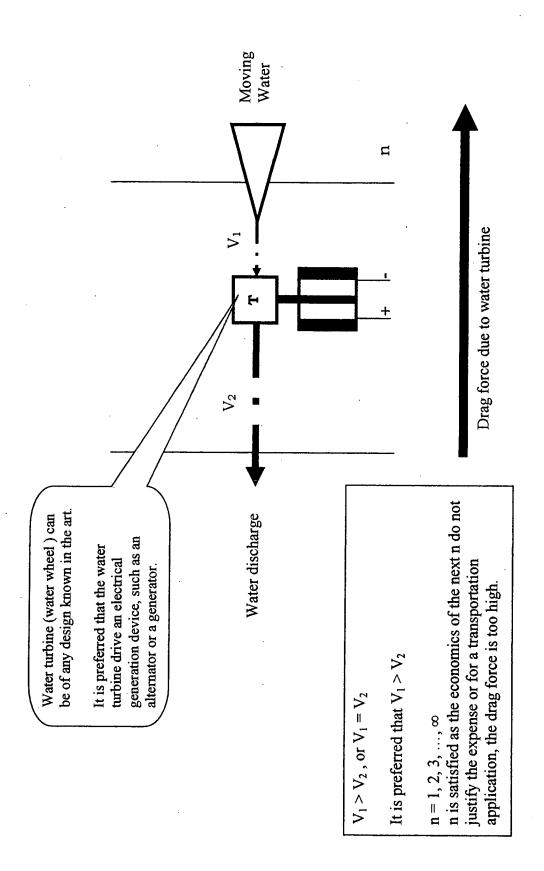
Moving generation device, such as an turbine drive an electrical Air It is preferred that the air Air turbine can be of any alternator or a generator. design known in the art.

Air to at least one of:

- 1. Discharge.
- Filter and Distillation,
- Filter and PSA, or
 Filter and membrane.



¤



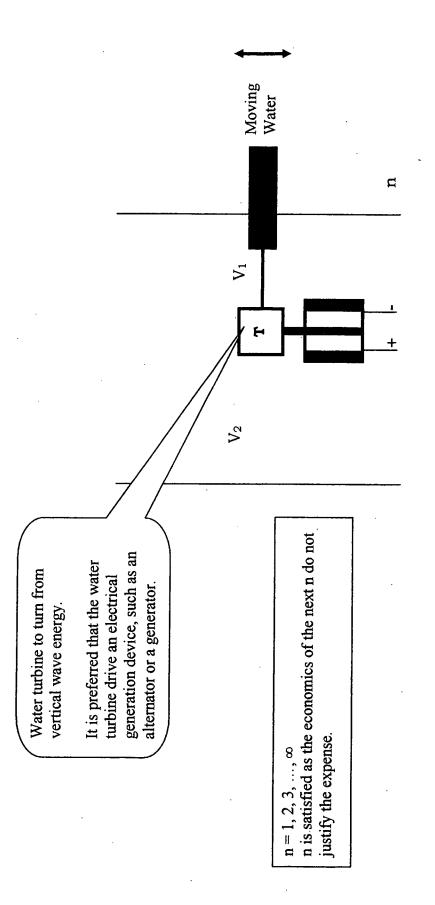


Figure 24
Pressure Control Configuration(s)

